

What is claimed is:

1. A method for detecting motion blur in a digital image, said method comprising:

providing image data representative of said digital image;

5 analyzing said image data to calculate a first figure of merit of said digital image in a first direction;

analyzing said image data to calculate a second figure of merit of said digital image in a second direction, said first and said second directions being substantially orthogonal;

10 calculating a first ratio of said first figure of merit to said second figure of merit, said ratio being the greater of said first or second figure of merit divided by the lesser of said first or second figure of merit; and

comparing said first ratio to a preselected value, wherein motion blur exists in said digital image if said first ratio is greater than said preselected value.

2. The method of claim 1, wherein said providing image data comprises providing a plurality of data values corresponding to a plurality of pixels representing said digital image.

3. The method of claim 2, wherein said calculating a figure of merit comprises calculating the summation of the absolute values of the differences of data values corresponding to adjacent pixels along an axis.

4. The method of claim 2, wherein said calculating a figure of merit comprises calculating the summation of the absolute values of the differences of data values corresponding to pixels spaced a preselected distance from each other along an axis.

5. The method of claim 1, wherein said providing image data comprises providing image data corresponding to a preselected color

component of said digital image.

6. The method of claim 1 and further comprising:

analyzing said image data to calculate a third figure of merit of said digital image in a third direction, said third direction being diagonal to said first direction and said second direction;

5 analyzing said image data to calculate a fourth figure of merit of said digital image in a fourth direction, said third and said fourth directions being substantially orthogonal;

calculating a second ratio of said first figure of merit to said second figure of merit, said second ratio being the greater of said third or fourth figure of merit divided by the lesser of said third or fourth figure of merit; and

10 comparing said second ratio to a preselected value to determine if motion blur is present in said digital image.

7. The method of claim 6, and further comprising comparing said first ratio to said second ratio to determine the direction of motion blur, wherein said direction of motion blur exists in the direction corresponding to the lowest value of a figure of merit from the greater of said first ratio or said second ratio.

8. The method of claim 1 and further comprising reducing motion blur by increasing the magnitude of the edge acuity of said image data in the direction of motion blur if motion blur exists.

9. The method of claim 1, and further comprising reducing motion blur by increasing the magnitude of the amplitude of spatial frequencies of said image data in the direction of motion blur if motion blur exists.

10. The method of claim 1, and further comprising reducing motion blur by increasing the magnitude of the amplitude of preselected spatial frequencies in said image data in the direction of motion blur if motion blur

exits.

11. The method of claim 1, and further comprising reducing motion blur by increasing the magnitude of the amplitude of the sinusoidal signals in a preselected set of spatial frequencies of the image in the direction of the motion blur.

12. The method of claim 1, wherein said providing image data comprises providing image data representative of a portion of said image.

13. A method for detecting motion blur in a digital image, said method comprising:

providing image data representative of said digital image;
analyzing said image data to calculate a plurality of first figures of merit
5 of said digital image in a plurality of directions;
analyzing said image data to calculate a plurality of second figures of merit of said digital image, wherein each of said second figures of merit is in a direction substantially orthogonal to a corresponding first figure of merit;
calculating a plurality of ratios of said first figures of merit to their
10 corresponding second figures of merit, each of said ratios being the greater of a first or second figure of merit divided by the lesser of its corresponding first or second figure of merit; and
comparing said ratios to a preselected value, wherein motion blur exists in said digital image if one of said ratios is greater than said
15 preselected value.

14. A method for reducing motion blur in an image, said method comprising:

providing image data representative of said image;
analyzing said image data to detect the presence of motion blur in said
5 image;
analyzing said image data to detect the direction of motion blur in said

digital image;

processing said image data to increase edge acuity said image in said direction of said motion blur.

15. The method of claim 14, wherein said analyzing said image data to detect the presence of motion blur comprises:

analyzing said image data to calculate a first figure of merit of said digital image in a first direction;

5 analyzing said image data to calculate a second figure of merit of said digital image in a second direction, said first and said second directions being substantially orthogonal;

10 calculating a first ratio of said first figure of merit to said second figure of merit, said ratio being the greater of said first or said second figure of merit divided by the lesser of said first or said second figure of merit; and

comparing said first ratio to a preselected value, wherein motion blur exists in said digital image if said first ratio is greater than said preselected value.

16. The method of claim 15, wherein said analyzing said image data to detect the direction of motion blur comprises determining the lowest value of said first and said second figures of merit, said lowest value corresponding to said direction of motion blur.

17. The method of claim 14, wherein said analyzing said image data to detect the presence of motion blur comprises:

analyzing said image data to calculate a plurality of first figures of merit of said digital image in a plurality of directions;

5 analyzing said image data to calculate a plurality of second figures of merit of said digital image, wherein each of said second figures of merit is in a direction substantially orthogonal to a corresponding first figure of merit;

calculating a plurality of ratios of said first figures of merit to their corresponding second figures of merit, each of said ratios being the greater of

10 a first or second figure of merit divided by the lesser of its corresponding first or second figure of merit; and

comparing said ratios to a preselected value, wherein motion blur exists in said digital image if one of said ratios is greater than said preselected value.

18. The method of claim 17, wherein said analyzing said image data to detect the direction of motion blur comprises determining which of said ratios has the highest value and determining the lowest figure of merit of said highest valued ratio, said lowest figure of merit corresponding to said direction of motion blur.

19. The method of claim 14, wherein said providing image data comprises providing image data representative of a portion of said image.

20. The method of claim 14, wherein said processing comprises increasing the magnitude of the amplitude of the signals in a preselected set of spatial frequencies of the transformed image data in the direction of the motion blur.

21. The method of claim 14, wherein said processing comprises increasing the magnitude of the amplitude of the sinusoidal signals in a preselected set of spatial frequencies of the transformed image data in the direction of the motion blur, wherein said image data is transformed by a Fourier transform.

22. The method of claim 21, and further comprising transforming said image data back to the spatial domain by an inverse Fourier transform.

23. The method of claim 14, wherein said processing comprises increasing the amplitude of signals of said image based on the detection and amplitude of motion blur.

24. A method for reducing motion blur in a digital image, said method comprising increasing the magnitude of the amplitude of the signals in a preselected set of spatial frequencies of the image in the direction of the motion blur.

25. The method of claim 24, wherein said signals are sinusoidal signals and wherein said spatial frequencies are derived via a Fourier transform.

26. The method of claim 24 and further comprising determining the direction of motion blur.

27. An apparatus for detecting motion blur in an image, said apparatus comprising a computer and a computer-readable medium operatively associated with said computer, said computer-readable medium containing instructions for controlling said computer to detecting motion blur in an image by:

5 receiving image data representative of said image;
calculating a first figure of merit of said image data in a first direction;
calculating a second figure of merit of said image data in a second
direction, said first and said second directions being substantially orthogonal;
10 calculating a first ratio of said first figure of merit to said second figure of merit, said ratio being the greater of said first or said second figure of merit divided by the lesser of said first or said second figure of merit; and
comparing said first ratio to a preselected value, wherein motion blur
exists in said digital image if said first ratio is greater than said preselected
15 value and motion blur exists in the direction corresponding to the lesser of said figures of merit.

28. An apparatus for reducing motion blur in an image, said apparatus comprising a computer and a computer-readable medium operatively associated with said computer, said computer-readable medium

containing instructions for controlling said computer to reduce motion blur in
an image by:

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determining the direction of motion blur; and

increasing the magnitude of the amplitude of spatial frequency in the
direction of said motion blur.

29. The apparatus of claim 28, wherein said increasing comprises
increasing the magnitude of the amplitude of the signals in a preselected set
of spatial frequencies of the image in the direction of the motion blur.

30. The apparatus of claim 28, wherein said increasing comprises
increasing the magnitude of the amplitude of the sinusoidal signals in a
preselected set of spatial frequencies of the image in the direction of the
motion blur, wherein said spatial frequencies are derived by way of a Fourier
transform.

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31. The apparatus of claim 30, wherein said image data is
transformed back to the spatial domain by an inverse Fourier transform.

32. A device for detecting motion blur in a digital image, said device
comprising:

means for analyzing image data representative of said digital image to
calculate a first figure of merit of said digital image in a first direction;

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means for analyzing said image data to calculate a second figure of
merit of said digital image in a second direction, said first and said second
directions being substantially orthogonal;

means for calculating a first ratio of said first figure of merit to said
second figure of merit, said ratio being the greater of said first or second
figure of merit divided by the lesser of said first or second figure of merit; and

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means for comparing said first ratio to a preselected value, wherein
motion blur exists in said digital image if said first ratio is greater than said
preselected value.